CATF FACT SHEET:

The Feasibility of Compressed Natural Gas Trucking in North Dakota's Little Missouri National Grassland

CLEAN AIR TASK FORCE

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Oil production has grown significantly from tight oil wells in the U.S. in recent years. In addition to oil, these wells produce large amounts of natural gas. Gas gathering pipelines remain the primary and most efficient way of getting gas off the well pad and on its way to users. However, in some cases wells are not connected to gas gathering pipeline infrastructure when they start producing oil and gas, or they are connected but associated gas production exceeds the pipeline capacity. As a result, **flaring of associated gas remains a significant problem in many tight oil fields, such as in North Dakota, where oil companies flare about a fifth of the gas they withdraw from the ground because of the lack of pipeline capacity to transport or use the gas.** Beyond wasting natural gas, flaring produces numerous pollutants, such as carbon dioxide, NO_x, and harmful, toxic products of incomplete combustion such as black carbon.

Flaring occurs despite the fact that there are flexible, proven ways to capture natural gas from these wells for sale or otherwise use it, beyond gas gathering pipelines. In a recent report, we highlighted several alternatives to flaring that are already being used in tight oil fields. These **technologies can significantly, and in many cases profitably, reduce flaring**.

One promising technology for use in the absence of gathering pipelines is **compressed natural gas (CNG) trucking, which can profitably reduce flaring from wellsites by over 90%.** CNG trucking systems compress associated gas and truck it to a gas processing plant or other point where it can be transported to market via a pipeline. CNG trucking is profitable at wells within a reasonable distance of gas processing infrastructure. The more wells at a well pad, and therefore the more associated gas production, the further the well pad can be from gas processing infrastructure while still deploying a profitable CNG trucking system. Based on our recent report, we estimate that CNG trucking will be profitable at single well pads within 5 miles of gas processing infrastructure. It can be profitable at multi-well pads within 20 miles of a gas processing plant, and at large multi-well pads (or several nearby multi-well pads) within 25 miles of a plant.

This raises the question - how much flaring takes place close enough to infrastructure for CNG trucking to be feasible? We explored this by examining flaring data from western North Dakota. We studied the pattern of flaring in the Little Missouri National Grassland (LMNG). This Grassland is remote, over a million acres, and surrounds Theodore Roosevelt National Park. We focused on this area in part because the Bureau of Land Management (BLM) oversees oil and gas production on Federal lands like LMNG, and BLM is currently writing rules to prevent waste of natural gas from the wells they oversee.

Within the borders of the LMNG, there is a mix of wells overseen by BLM and wells not overseen by BLM, due to private inholdings within the Grassland and split estate. However, whether considering all wells within the border of the LMNG, or wells in (and near) the LMNG producing oil and gas from Federal mineral estate, flaring is widespread and unnecessary.

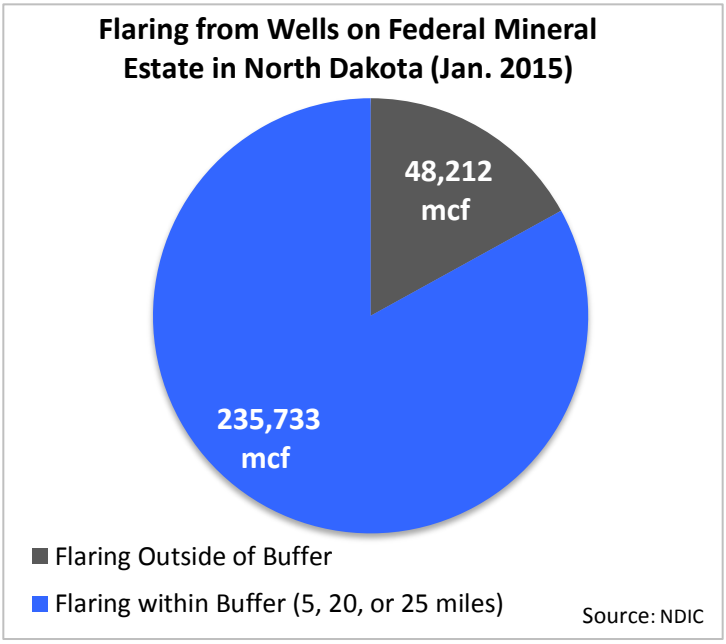
About 30% of the gas produced within the LMNG is flared because oil producers have not brought pipelines to their wells – in January 2015 they flared 1.3 billion cubic feet of gas.[1] Of the gas produced in (and near) LMNG

[1] Some have claimed that flaring is high on wells located on Federal lands such as LMNG because of difficulties in obtaining permits from BLM to install gas gathering pipelines. It is important to note that the data does not support this: Flaring levels historically are no higher Federal land than private land.

with minerals rights owned by the Federal government, 32%, or 285 million cubic feet, was flared in January. This is just a fraction of the 10.2 billion cubic feet of gas flared in North Dakota in January, but 285 million cubic feet is enough to meet the *January* natural gas demand for over 18,000 North Dakota homes.

And oil companies did not need to flare all of this gas: despite the remoteness of this area, CNG trucking is quite feasible.

As the map on the next page shows (the map focuses on wells producing gas from the Federal mineral estate), most wells that are flaring gas are close enough to natural gas plants to make CNG trucking feasible. The concentric circles around each plant show the area where single wells, multi-well pads, and larger multi-well pads can profitably truck gas to plants. The upshot is that of the 1,004 wells flaring gas produced from the Federal mineral estate in and around LMNG in January, 610 (61%) could economically truck CNG to gas plants. **Moreover, 83% of the gas flared from these wells in that month could have been captured in this way.**



If we change the domain to all wells within the boundaries of LMNG, whether producing from the Federal mineral estate or not, 89% of the gas flared could be trucked.

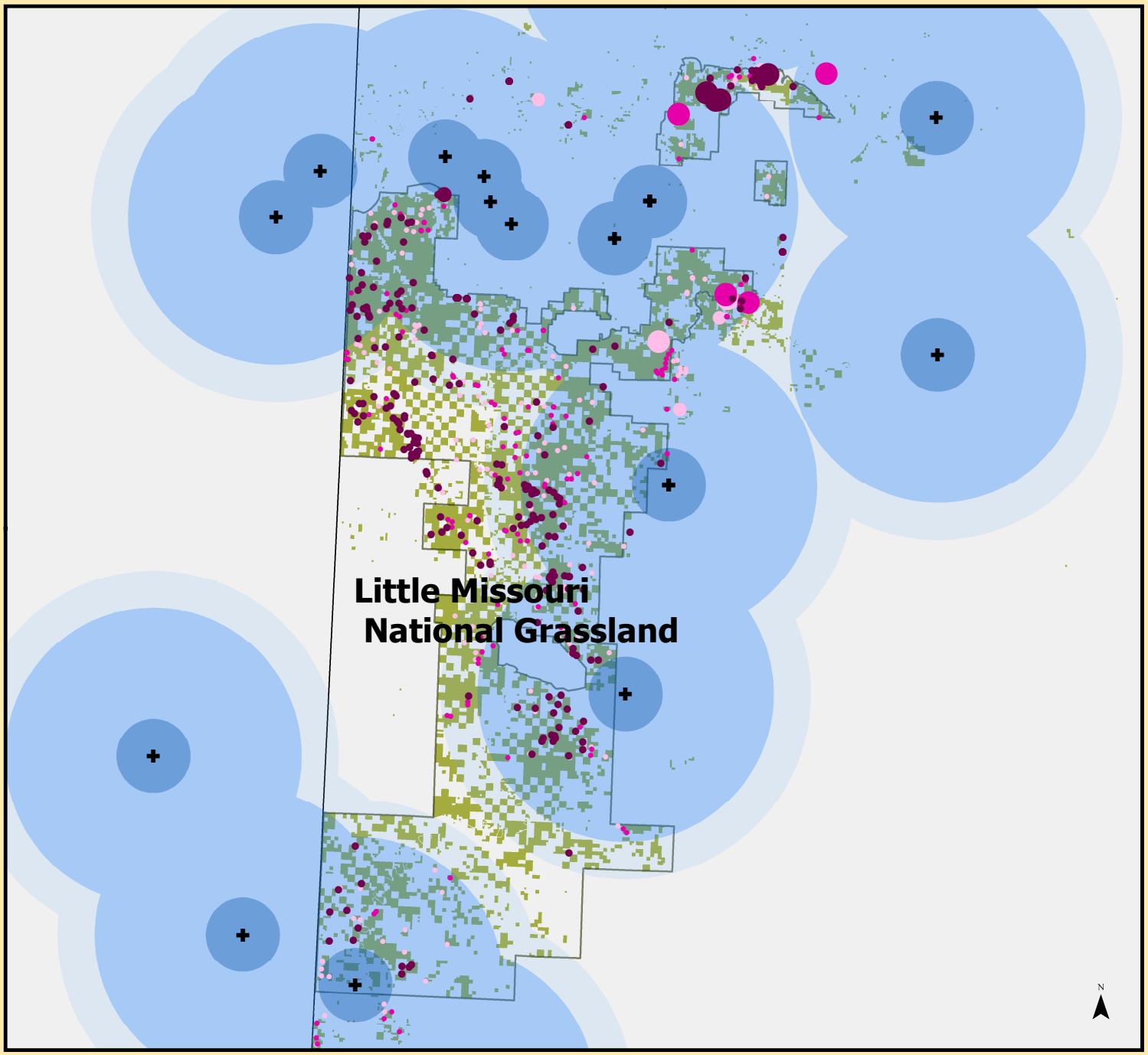
These figures represent a lower limit, for a number of reasons. Our report highlights several technologies that can utilize gas at wellsites, in addition to CNG trucking; we have not considered here how much gas could be economically captured with these other technologies, but they will generally be feasible and even economic at wellsites in LMNG. Furthermore, we are only able to analyze the economics of CNG trucking (and other approaches) on a wellsite-by-wellsite basis. In reality, economics will almost always be much more favorable for CNG trucking because well owners will be implementing the technology at dozens (or more) wellsites in an area, not at single sites. Finally, it is critical to note that many companies have successfully (and profitably) deployed traditional natural gas gathering pipelines in tight oil fields, including in the Bakken.

Considering all of the economic and technically feasible options oil companies have to make use of associated gas from their wells, or get it to market, it is clear that that there is no excuse for flaring it off, even in remote areas such as the wells that BLM oversees in western North Dakota.

North Dakota has recently issued regulations to reduce the rate of flaring from their wells, but these rules still allow oil companies to flare 23% of the gas they produce, and even after 2020 companies will be allowed to flare 10% of their gas. (According to EIA data, no other state with large oil production flares more than a few percent of its gas production.[2])

Oil producers are flaring gas for convenience because they are too rushed to get oil (which is much more lucrative) flowing before they have ensured that there are systems in place to make use of the gas that comes up with the oil. **Regulators must not continue to allow this wasteful and harmful practice. BLM and states should enact clear standards that phase out flaring of natural gas, because polluting the air by burning off this valuable natural resource is unnecessary.**

[2] The most recent year with valid data (as reported to EIA) for most states is 2011. For that year, Montana reported flaring 6% of gas production (likely due to flaring in the portion of the Bakken which stretches into MT) and South Dakota reported flaring 17%, but these states produce far less oil than North Dakota. Of states producing more than 30 million barrels of oil a year, none report flaring more than ~2%. However, we note that some states clearly under-report flaring–for example, Oklahoma reports no flaring whatsoever.



Legend

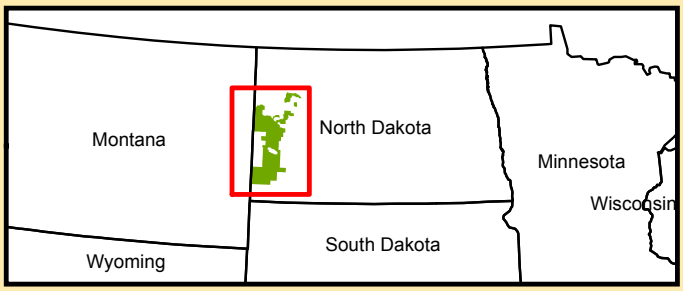
Wells Flaring in Jan. 2015

Single well pad - Profitable within ~5 miles of gas processing plant
- Under 2,500 mcf flared
- 2,500 to 5,000 mcf flared
- Over 5,000 mcf flared

Multi well pad (2 to 4) - Profitable within ~20 miles of gas processing plant
- Under 2,500 mcf flared
- 2,500 to 5,000 mcf flared
- Over 5,000 mcf flared

Multi well pad (more than 4) - Profitable within ~25 miles of gas processing plant
- Under 2,500 mcf flared
- 2,500 to 5,000 mcf flared
- Over 5,000 mcf flared

Gas Processing Plants
- Plant
- 5 mile radius
- 20 mile radius
- 25 mile radius



Feasibility of Compressed Natural Gas (CNG) Trucking for Flaring Wells on Federal Mineral Estate in North Dakota

Data from ND Industrial Commission January 2015

0 5 10 20 30 40 Miles

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